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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
MITCHELL, JAMES M	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 09/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/023,723	CHANDRAN ET AL.	
	Examiner	Art Unit	
	James M. Mitchell	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 June 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-5,7,9-17 and 27-43* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-5,7,9-17 and 27-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to applicant's amendment filed June 4, 2004.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 4, 5, 7, 27-31, 35-43 are rejected under 35 U.S.C. 102(b) as being anticipated by Love et al. (U.S. 5,773,889).

4. Love (Fig. 4) discloses (cl. 1, 27) an electronic assembly comprising: a substrate (12); a die (70); and a plurality of interconnections (80,04,16,20) between the substrate and die; wherein respective ones of the interconnections include a relatively low melting ("indium"; Col, 7, Lines 40-50) temperature and yield strength solder bump on the die, a relatively higher melting temperature and electrically conductive material standoff (14) on the substrate in the form of a stiff bump extending above a substrate surface and (cl.5) having a yield strength in the 350- 450 Mpa range (i.e. "copper"; Col. 45-49; per applicant's spec. P. 10), and a soldered joint connection (i.e. "mechanical" attachment from "reflow") between the solder bump and the electrically conductive material standoff; (cl.4) wherein the standoff is a bump in the form of a column or stud; (cl. 7) with the die having an inherent inter layer dielectric material (i.e. "IC" *fabrication*; abstract) under the plurality of interconnections; (cl. 28,35, 41) and a stress relieving

element (Col. 4, Lines 47-51) to absorb stress ("de-concentrating the mechanical stress") in a plurality of interconnections; (cl. 29, 36, 42) and the solder bump has a solder reflow finish (interpreted as an outer surface of a bump that's been reflowed); (cl. 30, 37, 43) and the solder comprises at least tin (Col. 7, Lines 27-51); (cl. 38,40) with the plurality of solder bumps are inelastically deformed (Fig 3; interpreted to mean don't inherently return back to same shape as a compressible material); (39) further discloses the bumps ("indium") having a lower yield strength (i.e. lower melting temperature) that the multiple contacts ("copper").

5. With respect to claims 1 and 27 process limitation of a "reflowed solder bump," the prior art structure is the same as the claimed invention. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Love et al. (U.S. 5,773,889).

8. Love discloses the elements stated in paragraphs 4 and 5 of this office action, but does not appear to show a top surface of the standoff wetted by the reflowed solder bump to form the soldered joint connection.

9. With respect to process limitation of the "standoff wetted," the prior art structure is the same as the claimed invention. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

10. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Love et al. (U.S. 5,773,889) as applied to claim 1 and further in combination with Milewski et al. (U.S. 6,330,967).

11. Love further disclose a ceramic substrate (Col. 12, Lines 20-22) and IC chip (abstract), but does not appear to show that coefficient of thermal expansion of the substrate is at least 15 ppm/°c and a coefficient of thermal expansion of the die is at least 2.7 ppm/°c less than that of the substrate and the substrate is more than two times greater than the coefficient of thermal expansion of the die.

12. Milewski utilizes a silicon IC chip (Col. 4, Lines 38-40).

13. It would have been obvious to one of ordinary skill I the art to form the chip of Love from silicon, such that coefficient of thermal expansion of the die is at least 2.7 ppm/°c less than that of the substrate and the substrate is more than two times greater than the coefficient of thermal expansion of the die (i.e. silicon chip & ceramic substrate; per applicant's spec. 10, 11) in order to provide an IC Chip as required by Love (Abstract).

14. Claims 11-17 and 32-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Love et al. (U.S. 5,773,889) in combination with Milewski (U.S. 6,330,967).

15. Love discloses a package substrate having a coefficient of thermal expansion of at least 15 ppm/°c (i.e. ceramic; Col. 12, Lines 20-22)), the package substrate having a plurality of relatively high melting temperature and electrically conductive standoff contact members (14) on the substrate; and an IC die/chip (70 & Abstract), a front side of the die having a plurality of relatively lower yield strength solder bumps (80) thereon, wherein the solder bumps are plastically deformed (interpreted to mean to behave like plastic/ deform upon heating) the die being electrically coupled to the substrate with a soldered joint connection (i.e. mechanical bond) between each of the solder bumps and a respective one of the standoff contact members (Col. 7, Lines 27-51); (cl. 13) and the standoff contact members (14) comprises a plurality of standoff elements upstanding from a surface of the substrate, and wherein each of the soldered joint connections connect the die to tops of respective ones of the standoff elements;

(cl. 14) and the standoff elements are non-melting at a solder liquidous temperature (i.e. copper has higher relfow/melting temperature; (Col. 8, Lines 29-49); and the standoff elements are copper bumps; (cl. 17) with the die having an inherent inter layer dielectric material (i.e. "IC" *fabrication*; abstract) under the plurality of interconnections; (cl. 32) and a stress relieving element (Col. 4, Lines 47-51) to absorb stress ("de-concentrating the mechanical stress") in a plurality of interconnections; (cl. 33) and the solder bump has a solder reflow finish (interpreted as an outer surface of a bump that's been reflowed); (cl. 34) and the solder comprises at least tin (Col. 7, Lines 27-51)

16. Love does not appear to show that a coefficient of thermal expansion of the die is at least 2.7 ppm/°c less than that of the substrate and the substrate is more than two times greater than the coefficient of thermal expansion of the die, or that a top surface of the standoff is wetted by the reflowed solder bump to form the soldered joint connection.

17. Milewski utilizes a silicon IC chip (Col. 4, Lines 38-40).

18. It would have been obvious to one of ordinary skill I the art to form the chip of Love from silicon, such that coefficient of thermal expansion of the die is at least 2.7 ppm/°c less than that of the substrate and the substrate is more than two times greater than the coefficient of thermal expansion of the die (i.e. silicon chip & ceramic substrate; per applicant's spec. 10, 11) in order to provide an IC Chip as required by Love (Abstract).

19. With respect to claims 11 process limitation of a "reflowed solder bump," and claim 16 process limitation of the "standoff wetted," the prior art structure is the same as

the claimed invention. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)

20. Claims 1,3-5, 7, 9-17, 23, 27, 29-31,33, 34, 36, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milewski (US 6,330,967) in combination with Admitted Prior Art (APA).

21. Milewski (Fig 4, 5A) discloses a ceramic substrate with a CTE of at least 15 ppm/° C (21; Col. 4, Lines 23-24; App. Spec p. 10) a die (10), a plurality of interconnections between the substrate and a Silicon die (10), wherein respective ones of the interconnections include a relatively low melting temperature solder bump (portion, 39 closest to 35) with an inherent yield strength (via there is a strength to the bond) on the die, a relatively higher melting temperature and electrically conductive, copper material (51) that extends a distance above the substrate and therefore is a standoff, in the form of a bump or column on the substrate, and an inherent soldered joint (portion of 39, closest to 51) connecting (i.e. a solder material, 39, is reflowed and has a portion of solder bonded to the pad and therefore has a solder joint connecting between the bump and contact) between the solder bump and the plurality of electrically conductive material, wherein the relatively higher melting temperature and electrically conductive material (51) on the substrate is formed as a standoff extending

above a surface of the substrate, and a top surface of the standoff is in the form of a column forming a stiff protuberance and therefore a bump and is inherently wetted by the solder to form the solder joint (Abstract, reflow; Column 5, Lines 42-43); wherein the standoff has an inherent yield strength of 350-450 Mpa (applicant spec. 6, via conventional interconnect scheme); and further that said substrate is a PCB that has in inherent inter layer dielectric material under the interconnection/ solder connection (via PCB comprised of dielectric laminates under interconnection) and that said die is Silicon, and a plurality (Fig 4) of non-melting standoff (via copper) at the solder liquidius temperature upstanding where the joints connect the die to tops of respective ones of the standoff elements; and the die has a front side (bottom portion) with a plurality of low melting temperature and yield strength solder bumps thereon, wherein the die is capable (Fig 4) of being coupled to the substrate with solder bumps connected to standoff; wherein the solder bumps are plastically/inelastically deformed (interpreted to mean to behave like plastic/ deform upon heating and not inherently return back to original shape like a compressible material; i.e. solder changes shape upon being reflowed; Fig 4, Fig 5A); and the bump, 39, comprises lead ("Pb/Sn"); and the bump has a solder reflow finish (i.e. outer surface of final reflowed bump) .

22. Milewski does not appear to explicitly disclose standoff being wetted by the reflowed solder bump or that the solder joint is connected to a reflowed solder joint or that the CTE of the substrate is at least 15 ppm/° C and the CTE of the die is 2.7 ppm/C less than that of the substrate, such that the CTE of the substrate is more than two times greater the CTE of the die.

23. However with respect to the process limitations of for example the "solder bump is wetted" or ""joint connected to ...reflowed solder," the prior art structure is the same as the claimed invention. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

24. APA (Spec 10-11) discloses silicon chips having a CTE of 2.7 ppm/° C

25. It would have been obvious to one of ordinary skill in the art to form the chip of Milewski with CTE of 2.7, in order to provide a silicon chip as required by Milewski (Fig 5A, "Si").

Response to Arguments

26. Applicant's arguments filed June 4. 2004 have been fully considered but they are not persuasive.

27. Applicant contends that the prior art Milewski teaches away from " a soldered joint connecting the reflowed solder bump," citing the previous office action where examiner stated that "Milewski does not appear to explicitly disclose the solder joint connected to a reflowed solder." Nevertheless, examiner respectfully disagrees with applicant's position of patentability.

28. Examiner's statement only indicated that there was no solder joint between an already reflowed bump and a contact, which is why the limitation was rejected as a product by process claim. However, Mileskwi discloses a solder material, 39, that is reflowed and that has a portion of the solder bonded to the pad and therefore a solder joint connecting between the bump and contact. The prior rejection has been modified only to address amendments made by applicant. In addition, new rejection Love (U.S. 5,773,889) is provided to address the new claims (i.e. "solder joint between" and "stress-relieving" limitations) and to further evidence lack of novelty.

Conclusion

29. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James M. Mitchell whose telephone number is (571) 272-1931. The examiner can normally be reached on M-F 8:00-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jmm
September 3, 2004

CARL WHITEHEAD, JR
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